

# COMPUTER GAME DEVELOPMENT EDUCATION AT UNIVERSITY

Mark Doughty  
University of Lincoln,  
Brayford Pool, Lincoln, UK  
mdoughty@lincoln.ac.uk

## KEYWORDS

Games computing, software development

## ABSTRACT

This paper articulates some of the challenges for computer game development courses at university level. A typical course development of this type is described. The need to include creative methods alongside more formal software development methodologies as core elements of computer game education is proposed and placed within the context of an industry specific framework. The evolutionary nature of the computer game industry requires that computer game development programmes at university should be equally evolutionary and adaptable to change.

## INTRODUCTION

The computer games industry has risen in global prominence and size during the last ten years (DFC Intelligence, 2004; SSC 2002). The contemporary appeal of interactive entertainment software has resulted in computer games being played by a much broader cross-section of society. This apparent 'legitimization' of gaming as an accepted leisure pastime has also resulted in the software development education sector responding. A wide variety of games development related degree awards have emerged into the university sector since 1997. Current UCAS (Universities and Colleges Admissions service) statistics list 25 universities or institutes offering 59 degree programmes (UCAS, 2004). The academic and skill focus of these awards varies with each institution. Programmes range from being arts and design based, to being purely focused on computer game programming and software development.

## CREATIVITY AND SOFTWARE ENGINEERING IN THE GAME DEVELOPMENT INDUSTRY

These two seemingly opposing concepts are both essential components for the success of a computer game product. Creative design and innovation are requirements for compelling gameplay and longevity of game products. Yet, while these are critical to a games success, if the development process is over

budget or deadlines are missed, the benefits of successful design are lost. Rucker proposes two criteria for a successful game: is it beautiful? and does it make money? (Rucker, 2003). These criteria sum up the competing needs for computer game software; games need to be compelling and offer a fun and entertaining experience, and they need to also be a success in the business sense.

Educating potential game developers to embrace and recognize both of these competing criteria requires a curriculum balanced with creative opportunity and software engineering methodology. While conventional thought may see these concepts as being difficult to coexist within a curriculum, it is proposed that not only can they coexist within a games computing curriculum, but that they are both necessary components.

The curriculum developed by many of the institutions listed in the UCAS statistics give students exposure and opportunity to develop skills in all main areas of game development. Students are encouraged to develop their own creativity and essential computing skills, and to recognize that software engineering methods are as important as creative design in the success of a computer game product.

## CASE STUDY: A TYPICAL COURSE DEVELOPMENT

During the mid nineties, the Faculty of Applied Computing Sciences at the University of Lincoln looked to consolidate its existing portfolio of computing degrees and also to expand into new and emerging computing disciplines such as computer game development, system security and media technologies. These developments were designed to bring the computing curriculum up to date, and also to respond to the changing demands of the undergraduate market. The first award, BSc(Hons) Computing (Games, Simulation & Virtual Reality), was validated for delivery in 1997. Refinements and refocusing of this undergraduate programme into BSc(Hons) Games Computing occurred in 2001.

The motivations for the development of games computing curricula at undergraduate level are numerous. The leisure software sector has experienced rapid growth, both globally and in the UK. Games software represents the majority of this market (SSC, 2002). The demand for undergraduate computing programmes in this field has increased in line with this increase in popularity of computer games as a leisure pastime. In developing a programme of study which addresses industry and student demand, a number of challenges need to be addressed. The challenges of acceptance of what is often seen as a 'non-academic' or 'rigor-less' subject are faced at both public and university management level. Students, and increasingly their parents, need to see that the course will deliver value for money and value in the job market, while university management need to ensure that standards and benchmarks are reached to ensure an effective educational experience for the student, as well as maintaining university quality responsibilities (THES, 2003). The games computing programme at Lincoln offers the basis for a career as a computing professional. It has undergone rigorous validation and approval to ensure that it meets the standards set by the Higher Education Funding Council for England (HEFCE).

Another critical challenge is the effective integration of creativity and free-form development, considered by many to be at the heart of innovative computer game development, with the structured and more formal nature of software engineering principles and practice.

The computer games industry thrives on creativity and innovation. New ideas, groundbreaking gameplay and interaction mechanisms drive the popularity – and ultimately sales – of computer game units. The responsibility of university games computing curricula is to encourage student activity and achievement in creation and innovation, while ensuring that more structured and formal software engineering principles are upheld as requisites for efficient and economic software development.

The rationale behind the development and operation of the BSc(Hons) Games Computing award is to produce graduates with critical and intellectual abilities within the games computing field, along with domain specific skills and experiences such as creative game design and game software development. In order to satisfy the demands of this rationale, the programme seeks to achieve a number of broad goals (University of Lincoln, 2001):

- To provide students with an education and learning experience that will equip them to operate on graduation as autonomous computing professionals;
- To develop professional and transferable skills in a wide range of methods, techniques and practices appropriate for the task domain of a professional computer game developer; and
- To develop a rich and up-to-date set of practices and techniques which students can deploy in state-of-the-art computer game software design and development contexts.

Curriculum design within the Faculty of Applied Computing Sciences follows a 'thematic' approach (Reeve, 2003). An undergraduate award is defined by a combination of two 'subject themes' and a single skills theme. A 'subject theme' is programme of study that addresses a particular cognate area or field of interest. (see Figure 1).

Subject of Computing	<ul style="list-style-type: none"> <li>▪ Computing theme</li> <li>▪ Games Computing theme</li> <li>▪ Software Development theme</li> <li>▪ Internet Systems theme</li> </ul>
Subject of Informatics	<ul style="list-style-type: none"> <li>▪ Informatics theme</li> <li>▪ Applied Informatics theme</li> </ul>
Subject of Media Technology	<ul style="list-style-type: none"> <li>▪ Media Technology theme</li> <li>▪ Digital Media theme</li> </ul>

*Figure 1: Curriculum themes within the Faculty of Applied Computing Sciences, University of Lincoln.*

The BSc(Hons) Games Computing undergraduate award is comprised of the two themes of Games Computing and Software Development. This combination is one, which reflects the recommendations of the International Game Developers Association (IGDA) for game related educational programmes. The IGDA Curriculum Framework (IGDA, 2003) acts as a guideline for university awards in the computer game development area. It describes the knowledge

areas and practical skills required to make and study games in a flexible format, which allows it to be adapted by individual institutions. Some issues faced when developing a programme of study within this framework are explored in the next section.

The recruitment history for the BSc(Hons) Games Computing at Lincoln shows a steady development and strengthening of the student base during the last six years of recruitment. This steady rise in recruitment figures could be seen as a consequence of the contemporary popularity of computer gaming, and reflects an increasing interest by potential undergraduates in the games computing field. It has also provided positive feedback to the staff evolving the degree.

### THE CHALLENGES OF MAPPING PROVISION TO INDUSTRIAL REQUIREMENTS

One of the aims of a provider of university undergraduate awards in any field, is to deliver relevant programmes of study which are responsive and reflective of the needs of the industries into which the graduates progress. The games computing industry is no different in this respect. It does, however, pose its own unique challenges to the developers and deliverers of undergraduate awards in this area.

Among the defining characteristics of a computer game product is the recognition that it is a synergistic combination of creative design effort and software development processes. This characteristic is reflected in the definition of the IGDA Curriculum Framework 'core topics' (see Figure 2). Practitioners and academics have defined these topic areas as a list of general areas relevant to the construction of a game-related curriculum. As acknowledged in the Framework document, no single curriculum can apply to all institutions delivering courses in this field; rather, each institution will interpret and apply its own resources to their course development within the guidance of the Framework.

Critical game studies
Games and society
Game design
Game programming
Visual design
Audio design
Interactive storytelling
Game production
Business of gaming

*Figure 2: IGDA Curriculum Framework core topics*

The faculty or department that develops an

undergraduate programme in this field will naturally utilize the talent and expertise, which are contained within its academic body. Faculties of art and design, for example, may interpret and implement an undergraduate games development programme in a different way to more technology-oriented faculties of computing or computer science.

The application of a guiding framework to an undergraduate degree programme can be enabling in that it can provide an amount of legitimacy and focus to the content. It can give students clear and transparent direction to their studies and their approaches to potential employers upon graduation. When developing or revising a programme of study, multiple frameworks may be referred to in the process. Guidelines such as the accreditation framework of the British Computer Society (BCS, 2004) can be equally applied to games development related programmes, and can indeed be complementary to an industry sector specific set of guidelines, such as the IGDA Curriculum Framework. Recent work commissioned by the Entertainment and Leisure Software Publishers Association (Steele et al, 2004) seeks to further the development of curriculum guidelines and to introduce the possibility of industry led accreditation for programmes of study.

Inspection of the IGDA Curriculum Frameworks core topics reveals that not only are the creative and aesthetic topic areas of computer game development ideally addressed by a programme of study, but that the more disciplined and structured elements of software development and software engineering principles should also be considered. It is evident from the IGDA Curriculum Framework that the games industry requires effective software engineering principles to be a core skill of any games related graduate. The use of software engineering processes in the game development cycle often ensures that games developers are able to learn from mistakes in previous developments (Rollings and Morris, 2000). Rollings and Morris go on to offer a detailed argument and case study material to support this statement.

The evolution of Games Computing programme at Lincoln has been one that reflects this need for software engineering practice. With these factors in mind curriculum development is ongoing, and seeking to identify and apply effective pedagogic principles that incorporate creative practice along with traditional software engineering principles. This has led to new developments in interdisciplinary research by staff from the Faculty of Applied Computing Sciences and

the School of Architecture at the University of Lincoln (O'Coill and Doughty, 2004; Rank et al., 2004). This research is continuing to explore and take advantage of the application of computer game technologies to participatory design within community based architecture projects.

## CONCLUSION

The key requisite of any university based computer game development programme is that it has relevance and responsiveness. The game industry has evolved rapidly during the last twelve years, and as a result demands for graduates with specialist knowledge and skills in the games computing field has raised. The development of university-based courses delivered by computing, media and technology based faculties has taken place in line with this industry expansion. Rather than relying purely on graduates from generic disciplines of, for example, computer science, physics and mathematics, the industry can now select from specialist graduates from games related programmes.

One key aspect of the games industry which needs to be reflected in the university based educational programmes is the combination of creative and innovative thinking along with the application of structured software development practices. This aspect is one, which is reflected by the IGDA Curriculum Framework guidelines, and one that is central to the development of the computer games programme at the University of Lincoln.

## REFERENCES

British Computer Society, 2004 *Guidelines on Course Accreditation and Exemption* <http://www.bcs.org/BCS/Products/HEAccreditation/courseguidelines.htm>

DFC Intelligence. 2004. *The Business of Computer and Video Games 2004*. [www.dfcint.com](http://www.dfcint.com)

Steele, B., Parry, P., Marshall, I., "Proposed Accreditation Scheme for University Courses Delivering Learning for the Entertainment Software Industry" ELSPA Working Paper, version 1, Feb, 2004.

Spectrum Strategy Consultants. 2002. *From Exuberant Youth to Sustainable Maturity: Competitive Analysis of the UK Games Software Sector* Department for Trade and Industry.

IGDA Education Committee. 2003. *IGDA Curriculum Framework: The Studies of Games and Game Development*, v2.3beta. [www.igda.org/academia](http://www.igda.org/academia)

O'Coill, C., Doughty, M. 2004. "Computer Game Technology as a Tool for Participatory Design". In *Proceedings of eCAADe*, September 15 – 18, Copenhagen, 2004.

Rank, S., O'Coill, C., Boldyreff, C., Doughty, M. 2004. "Software, Architecture and Participatory Design." In *Proceedings of SIGSOFT 2004/FSE-12 Workshop on Interdisciplinary Software Engineering Research (WISER2004)*, November 5, 2004. Newport Bch. Ca.

Reeve, P. 2003. *Curriculum Model*. University of Lincoln, Faculty of Applied Computing Sciences, UK.

Rucker, R. 2003 *Software Engineering and Computer Games* Addison Wesley.

Rollings, A., Morris, D. 2000 *Game Architecture and Design* Coriolis Technology Press.

THES, *Now Games Fans Can Console Themselves* Times Higher Education Supplement 21/11/03